The London Close Reasoner HISTORICAL NOTE 10

Mill's Four Methods of Experimental Inquiry

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HISTORY

John Stuart Mill (1806-73) was the most important philosopher writing in English in the nineteenth century. Close reasoners will already be familiar with his *On Liberty*, and its stout defence of freedom of thought and expression. That essay appeared in 1859, but long before, in 1843, Mill had made a name for himself with his *A System of Logic, Ratiocinative and Inductive.*

Still earlier, Mill had published a review of Whately's *Elements of Logic* when that book came out in 1828, and had even then formed the idea of doing something better, especially in the area of scientific method. Mill was what philosophers call an *empiricist*; he believed that knowledge rests on experience and, in the tradition of Francis Bacon, he saw that fact as the key to the advancement of science. This means an emphasis on inductive rather than deductive logic.

Mill's book was very influential. A biographer says:

Alan Ryan (1974)

> The *Logic* occupies a central place in Mill's writings, though it is not in the nature of the case a widely-read book today. It did exercise a considerable influence in its heyday: it went into eight editions, including a cheap edition for working-class readers, and it became a textbook for the study of logic in most English and many foreign universities. (p. 60)

Among the foreign universities was the University of Toronto. Our library at The University of Western Ontario has a copy of Mill's *Logic* which appears to have been used as a textbook there. Pasted into the book are questions from the final exams in *Metaphysics and Ethics* for 1873 and for 1874 set by Rev. George Paxton Young, M.A.; page numbers where the answers are to be found have been added in pencil. One hopes that these diligent students passed.

THE FIVE CANONS

The part of the book most closely studied then and even now, in simplified form in elementary textbooks, is Book III, *Of Induction*, and especially Chapter VIII, *Of the Four Methods of Experimental Inquiry.* These four are **Mill's Methods:** Agreement, Difference, Residues and Concomitant Variations. Mill adds a fifth, the combination of Agreement and Difference, called the Joint Method, and summarizes them all in five **regulative principles,** which he calls ***Canons***:

Mill (1843)

First Canon
[Method of Agreement]

> *If two or more instances of the phenomenon under investigation have only one circumstance in common, the circumstance in which alone all the instances agree, is the cause (or effect) of the given phenomenon.* (p. 224)

Second Cannon
[Method of Difference]

> *If an instance in which the phenomenon under investigation occurs, and an instance in which it does not occur, have every circumstance save one in common, that one occurring only in the former; the circumstance in which alone the two instances differ, is the effect, or cause, or a necessary part of the cause, of the phenomenon.* (p. 225)

Third Canon
[Joint Method of Agreement and Difference]

> *If two or more instance in which the phenomenon occurs have only one circumstance in common, while two or more instances in which it does not occur have nothing in common save the absence of that circumstance; the circumstance in which alone the two sets of instances differ, is the effect, or cause, or a necessary part of the cause, of the phenomenon. (p. 229)*

Fourth Canon
[Method of Residues]

Subduct from any phenomenon such part as is known by previous inductions to be the effect of certain antecedents, and the residue of the phenomenon is the effect of the remaining antecedents. (p. 230)

Fifth Canon
[Method of Concomitant Variations]

Whatever phenomenon varies in any manner whenever another phenomenon varies in some particular manner, is either a cause or an effect of that phenomenon, or is connected with it through some fact of causation. (p. 233)

Much progress has been made since Mill's time in inductive logic and scientific method, especially with the development in mathematics of statistics and the theory of probability, but Mill's methods are still useful as far as they go.

And sound too, if taken in the right spirit. These are not rules to be followed blindly and mechanically, but rather guidelines suggesting in what direction the solution to a problem may lie.

EXAMPLES

Mill gives many examples of the use of his methods drawn from the science of his day, and in the UWO copy these have been carefully annotated in the margin by some U of T student.

One example is the explanation of dew given by the astronomer John Herschel. The Method of **Agreement** tells us that the cause is that the object on which moisture condenses is colder than the surrounding air. We just bring together natural dew (Herschel used a thermometer), and condensation on a glass of cold water fresh from the well, on the window when there is a chill, and on a cold object when we breath on it.

Then the Method of **Difference** takes us further when we notice that there will sometimes be dew on pane of glass when there is not on a sheet of polished metal. This tells us that difference in substance can make a difference, but there are lots of differences between glass and metal.

To go farther we may follow this up by getting quantitative and discovering that the amount of dew that falls on a substance varies with the degree to which the substance conducts heat. This is the Method of **Concomitant Variations.** Herschel took this three prong approach, Agreement, Difference, Concomitant Variations, much farther, bringing in a number of other variables.

For the Method of **Residues** Mill discusses an example that is not without contemporary relevance:

Mill (1843)

. . . if it be possible to establish, what is now generally rather assumed than proved, that there is in one human individual, one sex, or one race of mankind over another, an inherent superiority in mental faculties, this must be proved by subtracting from the differences of intellect which we in fact see, all that can be traced by known laws either to the ascertained differences of physical organization, or to the differences which have existed in the outward circumstances in which the subjects of the comparison have hitherto been placed. What these causes might fail to account for, would constitute a residual phenomenon, which and which alone would be evidence of an ulterior original distinction, and the measure of its amount. But the strongest assertors of such supposed differences have hitherto been very negligent of providing themselves with these necessary logical conditions of the establishment of their doctrine. (pp. 249-50)

As we are all too aware, the question has been much debated of late whether Professor Rushton has provided himself with these necessary logical conditions. But that they are in fact necessary has been clear for some time.

Mill, John Stuart. *A System of Logic.* New York: Harper & Brothers, 1867.

Ryan, Allan. *J. S. Mill.* London: Routledge & Kegan Paul, 1974.

Venn, John. *The Principles of Empirical or Inductive Logic* 2nd edition. New York: Burt Franklin, 1972, a photomechanical reprint of the original of 1907.

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